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REPORT OF WATER QUALITY CRITERIA, CALUMET AREA - LOWER LAKE MICHIGAN

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REPORT OF

WATER QUALITY CRITERIA

CALUMET AREA-LOWER LAKE MICHIGAN

JANUARY 14th 1966

4th Edition

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Mr. R. S. Nelle Illinois Sanitary Water Board Springfield, Illinois	Mr. Benn J. Leland Illinois Sanitary Water Board Chicago, Illinois

WATER QUALITY CRITERIA
CALUMET AREA-LOWER LAKE MICHIGAN

INTRODUCTION

This report on the Calumet Area and Lower Lakes of Michigan is adapted from a report "Recommended Water Quality Criteria" submitted by a Technical Committee appointed in April, 1965.

A conference on pollution of the interstate waters of the Grand Calumet River, Little Calumet River, Calumet River, Wolf Lake, Lake Michigan and their tributaries (Indiana-Illinois), called by the Secretary of Health, Education, and Welfare under the provisions of Section 8 of the Federal Water Pollution Control Act (33 USC 466 et seq.), was held in Chicago, Illinois, March 2-9, 1965.

Conclusions and recommendations of the conferees included the following items that are pertinent to this report:

> "The conferees will establish a technical committee as soon as possible which will evaluate water quality criteria and related matters in the area covered by the conference and make recommendations to the conferees within six months after the issuance of the summary of the conference."
>
> "The Indiana Stream Pollution Control Board, the Illinois Sanitary Water Board, and the Metropolitan Sanitary District of Greater Chicago, maintaining close liaison with the technical committee created by the conferees will develop a time schedule for the construction of necessary industrial waste treatment facilities. Such a schedule shall be submitted to the conferees for their consideration within six months after the issuance of the summary of this conference."

Subsequently the conferees met on April 7, 1965 and appointed the technical committee which held its initial session on the same date. Since then the committee has met at approximately two-week intervals, with most of the meetings continuing for two days.

The committee consisted of one representative of each of the four regulatory agencies (the States of Illinois and Indiana, the Metropolitan Sanitary District of Greater Chicago, and the Federal government), two representatives of industry (U.S. Steel Corporation and American Oil Company) and one each of the City of Chicago Department of Water and Sewers, and the U. S. Department of the Interior.

GUIDE LINES FOR ADOPTING BASIC CRITERIA

At its second meeting the committee agreed on the following guidelines for its deliberations:

"Water quality criteria for various uses will be applied to the existing situations. The criteria that are developed will recognize the existing water quality, the need for improvement of water quality in certain areas, and the possibility that criteria will not be limited by existing levels in all cases. It is realized that quality criteria set at present cannot be binding for all time but will need reconsideration and possible revision at regular intervals in the future. Water quality needs for present and potential uses will be considered. Effluent standards will not be considered by this committee."

Considerable discussion was devoted to definition of the phrase "water quality criteria" used by the conferees in their charge to the committee. Relying on the usual interpretation of the word "criteria," it was concluded that the conferees intended that limits of constituents recommended by the committee would be used as guides in judging the suitability of water quality for various uses and in planning improvements in water quality through waste reductions where needed, but would not necessarily be applied as standards or requirements.

BASES FOR DEVELOPMENT OF CRITERIA

After considering various bases for development of water quality criteria the committee agreed that criteria should be based on:

1. Present and potential water uses.
2. Preservation of present good quality.
3. Improvement of degraded quality where technically and economically feasible.
4. Reconsideration and revision of regular intervals as future developments may dictate.

It was concluded that adoption of uniform criteria for specific uses, regardless of location of uses, would not provide a practical basis for a polution abatement program for lake waters. For example, the sheltered areas between the Calumet Harbor Breakwater and the Indiana Harbor Bulkhead (Figure 1 - Appendix) receives the major discharges from waste sources. Obviously, it is impractical to expect water of the same high quality in this area, regardless of the degree of waste treatment achieved, as that which will be found several miles out in the open lake. If the sources of municipal supply in the sheltered area are given adequate protection, the water in the open lake inevitably will be of still better quality.

Based on this reasoning, the water area of the lower lake was divided into three zones as shown in Figure 1. Most of the water area is defined as Open Water, which is that area more than 200 yards offshore and outside of a line from the outer end of the Calumet Harbor Breakwater to and along the outer edge of the Inland Steel Bulkhead Line and thence through the U. S. Steel Water Supply intake to the outer end of the Gary Harbor Breakwater. The Inner Harbor Basins is the area shoreward of the above line, but not including Shore Water. Shore Water is all water within 200 yards of shore except in the Inner Harbor Basins, where it is that water within 200 yards of existing onshore recreational areas.

Other water bodies for which criteria were developed included the Little Calumet River, the Grand Calumet River, and Wolf Lake. The reach of the Little Calumet River involved is from the state line to the confluence with the Cal-Sag Channel. In accordance with Federal jurisdiction in interstate enforcement it was concluded that the committee should concern itself with only those reaches of the two rivers that are downstream from the State line in Illinois, and with that portion of Wolf Lake that lies in Illinois.

General water use categories were adopted for the development of criteria. These water uses are:

1. Municipal Water
2. Industrial Water

   Process - Cooling
3. Recreation
   a. Whole Body Contact
   b. Limited Body Contact
4. Fish and Wildlife
5. Commercial Shipping

6. Esthetics

7. Wastewater Assimilation

Existing and potential uses of the delineated bodies of water for which quality criteria were considered are noted in Table I (Appendix). The locations of principal water uses are shown in Figures 2A and 2B (Appendix). Although there has been use of water for irrigation in the Little Calumet Basin, it has been so limited that it was concluded this very minor use did not justify special consideration.

Constituents for which water quality criteria were considered for each of the bodies of water are indicated in Tables II through VI (Appendix). It should be noted that the constituents for both Open Water and the Inner Harbor Basins, given in Table II, are the same.

Criteria first were selected for each constituent for each water use in each area. Once the complete tabulation of criteria for all water uses in an area had been developed, the most stringent criteria for any of the water uses were selected as the governing values for that area.

Some of the criteria recommended are at or near the lower limits of detectability of analytical procedures included in "Standard Methods for the Examination of Water and Wastewater." The committee concludes that "Standard Methods" of analysis should be employed where applicable, but recognizes that other approved methods may be required in judging compliance with some of the criteria. For example, the committee recommends an annual average of 0.02 mg/l and a single daily value of 0.05 mg/l of ammonia nitrogen in the open water of the lake. The limit of detectability of this compound by the "Standard Methods" procedure may be as low as 0.03 mg/l, but reproducibility is erratic below 0.1 mg/l. However, the accepted method used by the Great Lakes-Illinois River Basins Project Laboratory has a sensitivity and precision of 0.01 mg/l.

Successful application of the criteria requires that analytical results be reproducible among the several laboratories involved in the program. A round-robin program of replicate sample analysis recommended by the committee has been initiated by the laboratories to ensure reproducibility of results.

A major, and probably the major, water quality problem of the area is taste and odor in municipal water supplies. The types of taste and odor most difficult and costly to control by water treatment are "chemical", or "hydrocarbon", and "medicinal", or "phenolic". Since the "Standard Method" for threshold odor is recognized as subjective rather than objective, it is especially important that every effort be exerted to ensure the maximum possible reproducibility of threshold odor results among the laboratories.

CRITERIA

The criteria recommended by the Committee are incorporated in the following tables, 1 through 6. The Committee feels that it is establishing a precedent in recommending criteria which, if attainable, will ensure the highest quality water that is reasonably feasible.

TABLE 1

CRITERIA

OPEN WATER

Control Points - Chicago South District Filtration Plant and Gary-West Plant Intakes

Coliform Bacteria - MPN/100 ml	
Annual Average (Arithmetic)	Not more than 200
Single Daily Value or Average (1)	Not more than 2,500
Fecal Streptococci - Number/100 ml (Tentative) (2)	Not more than 25
Turbidity	
No turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of the water.	
True Color - Units	
Annual Average	Not more than 5
Single Daily Value or Average	Not more than 15
Threshold Odor (Hydrocarbon and/or Chemical) (3)	
Daily Average	Not more than 4
Single Value	Not more than 8
Odor	
No obnoxious odor of other than natural origin.	
Temperature - °F	Not more than 85
Oil	
Substantially free of visible floating oil.	
Floating Solids and Debris	
Substantially free of floating solids and debris from other than natural sources.	
Bottom Deposits	
Substantially free of contaminants that will: (1) adversely alter the composition of the bottom fauna; (2) interfere with the spawning of fish or their eggs; (3) adversely change the physical or chemical nature of the bottom.	
pH - Units	
Annual Median	Within range 8.1 - 8.4
Daily Median	Within range 7.7 - 9.0

TABLE 1 (Continued)

CRITERIA (Continued)

OPEN WATER

Dissolved Oxygen - Per Cent Saturation						
Annual Average	Not less than 90					
Single Value	Not less than 80					
Ammonia Nitrogen (N) - mg/1 (4)						
Annual Average	0.02					
Single Daily Value or Average	0.05					
Total Nitrogen (N) (4)	0.4					
Methylene Blue Active Substance - mg/1						
Annual Average	Not more than 0.05					
Single Daily Value or Average	Not more than 0.20					
Chlorides (CL) - mg/1		**1965**	**1970**	**1980**	**1990**	**2000**
Annual Average	Not more than	8	9	10	11	12
Single Daily Value or Average	Not more than			15 (through 1970)		
Cyanides (CN) - mg/1						
Single Value	Not more than 0.025					
Fluorides (F) - mg/1						
Annual Average	Not more than 1.0					
Single Daily Value or Average	Not more than 1.3					
Dissolved Iron (Fe) - mg/1						
Annual Average	Not more than 0.15					
Single Daily Value or Average	Not more than 0.30					
Phenol-like Substances - mg/1 (Tentative) (5)						
Annual Average	Not more than 0.001					
Single Value	Not more than 0.003					
Sulfates (SO_4) - mg/1		**1965**	**1970**	**1980**	**1990**	**2000**
Annual Average	Not more than	23	24	26	28	30
Single Daily Value or Average	Not more than			50 (through 1970)		
Total Phosphates (PO_4) - mg/1 (Tentative) (6)						
Annual Average	Not more than 0.03					
Single Daily Value or Average	Not more than 0.04					

TABLE 1 (Continued)

CRITERIA (Continued)

OPEN WATER

Filtrable Residue (Total Dissolved Solids (mg/1)		1965	1970	1980	1990	2000
Annual Average		162	165	172	179	186
Single Daily Value or Average	Not more than			200 (through 1970)		

Miscellaneous Trace Contaminants and Radionuclides

Shall not be present in concentrations that will prevent meeting PHS 1962 Drinking Water Standards after conventional treatment.

(1) If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

(2) Pending accumulation of adequate data on existing densities of Streptococcus. Probably can be lowered.

(3) The Chicago South District Filtration Plant Control Laboratory will be the reference laboratory for Threshold Odor.

(4) Tentative pending study of additional data and evaluation of potential reductions at the sources.

(5) Pending study of additional data and evaluation of potential reductions at the sources.

(6) Pending thorough determination of existing concentration in Lower Lake Michigan Conference Area.

TABLE 2

CRITERIA

INNER HARBOR BASINS

Control Points - Hammond and East Chicago Water Intakes

Coliform Bacteria - MPN/100 ml.

Annual Average (Arithmetic)	Not more than 2,000
Single Daily Value or Average	Not more than 5,000 (1)

Fecal Streptococci - Number/100 ml — Not more than 100

Turbidity

No turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of water.

True Color - Units

Annual Average	Not more than 5
Single Daily Value or Average	Not more than 15

Threshold Odor (Hydrocarbon and/or Chemical) Units (2)

Annual Average	Not more than 8
Single Daily Value or Average	Not more than 20

Odor

No obnoxious odor of other than natural origin.

Temperature - °F — Not more than 85

Oil

Substantially free of visible floating oil.

Floating Solids and Debris

Substantially free of floating solids and debris from other than natural sources.

Bottom Deposits

Substantially free of muck and debris of other than natural origin.

pH - Units

Annual Median	Within range 8.0 - 8.5
Daily Median	Within range 7.5 - 9.0

Dissolved Oxygen - Per Cent Saturation

Annual Average	Not less than 80
Single Daily Value or Average	Not less than 65

TABLE 2 (Continued)

CRITERIA (Continued)

INNER HARBOR BASINS

Ammonia Nitrogen - mg/1 (2)						
Annual Average				0.05		
Single Daily Value or Average				0.12		
Methylene Blue Active Substance - mg/1						
Annual Average			Not more than 0.10			
Single Daily Value or Average			Not more than 0.30			
Chlorides - mg/1		1965	1970	1980	1990	2000
Annual Average	Not more than	16	18	20	22	24
Single Daily Value or Average	Not more than			30 (through 1970)		
Cyanides - mg/1						
Single Value			Less than	0.1		
Fluorides - mg/1						
Annual Average			Not more than 1.0			
Single Daily Value or Average			Not more than 1.3			
Dissolved Iron - mg/1						
Annual Average			Not more than 0.15			
Single Daily Value or Average			Not more than 0.30			
Phenol-like Substances - mg/1 (Tentative) (2)						
Annual Average			Not more than 0.002			
Single Daily Value or Average			Not more than 0.005			
Sulfates - mg/1		1965	1970	1980	1990	2000
Annual Average	Not more than	35	36	39	42	45
Single Daily Value or Average	Not more than			75 (through 1970)		
Total Phosphates - mg/1 (Tentative) (2)						
Annual Average			Not more than 0.05			
Single Daily Value or Average			Not more than 0.10			
Filterable Residue (Total Dissolved Solids) - mg/1		1965	1970	1980	1990	2000
Annual Average	Not more than	187	190	197	204	211
Single Daily Value or Average	Not more than			230 (through 1970)		

TABLE 2 (Continued)

CRITERIA (Continued)

INNER HARBOR BASINS

Miscellaneous Trace Contaminants and Radionuclides

Shall not be present in concentrations that will prevent meeting PHS 1962 Drinking Water Standards after conventional treatment.

(1) Except during periods of storm water overflow when coliform should not exceed 24,000/100 ml.

(2) Tentative pending study of additional data and evaluation of potential reductions at the sources.

If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

TABLE 3

CRITERIA

SHORE WATER

Control Points - Existing Sampling Points at Bathing Beaches.

Bacteria - Number per 100 ml by MF Techniques (Tentative) (1)

a) The number of bacteria shall be the Arithmetic Average of the last five consecutive sample results.

c) Satisfactory area if MF Coliform are less than 1000 and MF Fecal Streptococci are less than 100.

c) Satisfactory area if MF Coliforms are from 1000 to 5000 and MF Fecal Streptococci are less than 20.

d) A single sample results of over 100,000 Coliforms shall require immediate investigation as to the cause. Items to be considered in the judgment of cause and action to be taken include the sanitary survey, winds, currents and weather conditions.

Turbidity

No turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of water.

True Color - Units

Annual Average	Not more than 5
Single Daily Value or Average	Not more than 15

Odor

No obnoxious odor of other than natural origin.

Temperature - °F — Not more than 85

Oil

Substantially free of visible floating oil.

Floating Solids and Debris

Substantially free of floating solids and debris from other than natural sources.

Bottom Deposits

Substantially free of muck and debris of other than natural origin.

pH - Units

Daily Median — Within range 7.0 - 9.0

TABLE 3 (Continued)

CRITERIA (Continued)

SHORE WATER

Dissolved Oxygen - Per Cent Saturation	
Annual Average	Not less than 90
Single Value	Not less than 80
Ammonia Nitrogen (N) - mg/1 (Tentative) (2)	
Annual Average	Not more than 0.05
Single Daily Value or Average	Not more than 0.12
Methylene Blue Active Substance - mg/1	
Annual Average	Not more than 0.02
Single Daily Value or Average	Not more than 0.05
Cyanides (CN) - mg/1	
Single Value	Not more than 0.025
Phenol-like Substances - mg/1 (Tentative) (2)	Not more than 0.05
Total Phosphates (PO_4) - mg/1 (Tentative) (3)	
Annual Average	Not more than 0.03
Single Daily Average or Value	Not more than 0.04

Miscellaneous Trace Contaminants and Radionuclides

Shall not be present in concentrations that will prevent meeting the PHS 1962 Drinking Water Standards after conventional treatment.

(1) Pending evaluation of data on bathing beaches during 1965 which are now being collected.

(2) Pending study of additional data and evaluation of potential reductions at the sources.

(3) Pending thorough determination of existing concentrations in Lower Lake Michigan Conference Area. Lower limits may be desirable.

If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

TABLE 4

CRITERIA

LITTLE CALUMET RIVER

Control Point - Wentworth Avenue Bridge.

Coliform Bacteria - MPN/100 ml

Maximum Value 5000 except during periods of storm water runoff.

Fecal Streptococci - Number/100 ml

Maximum value 500 except during periods of storm water runoff

Turbidity

No turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of the water.

True Color - Units

Annual average not more than 25

Single Daily value or average not more than 50(1)

Odor

No obnoxious odors of other than that of natural origin.

Temperature °F

Single daily value or average not more than 90.

Oil

Substantially free from visible floating oil.

Floating Solids and Debris

Substantially free of floating solids and debris from other than natural sources.

Bottom Deposits

Substantially free of sludge banks.

pH - Units

Annual median within range 6.5 - 9.0

TABLE 4 (Continued)

CRITERIA (Continued)

LITTLE CALUMET RIVER

Dissolved Oxygen - mg/1

Average (May through September) not less than 4.0

Single daily value or average not less than 2.0

BOD - mg/1

Single daily value or average not more than 10.0

Ammonia Nitrogen - mg/1 (2)

Single daily value or average not more than 1.5

Methlene Blue Active Substance - mg/1

Single daily value or average not more than 0.5

Cyanides - mg/1

Single daily value or average not more than 0.025

Phenol-like Substances - mg/1

Single daily value or average not more than 0.02

Total Phosphates - mg/1 (2)

Held for additional data analysis. (Appears to be from surface runoff.)

(1) If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

(2) Tentative pending study of additional data and evaluation of potential reductions at the sources.

TABLE 5

CRITERIA

GRAND CALUMET RIVER [1]

Control Point - Baltimore and Ohio Chicago Terminal Railroad Bridge.

Coliform Bacteria MPN/100 ml. (Tentative)

Maximum Value 5000 except during periods of storm water runoff.

Fecal Streptococci - Number/100 ml

Maximum value 500 except during periods of storm water runoff.

True Color - Units (Tentative)

Annual Average	25
Single Daily Value or Average[2]	Not more than 50

Odor

No obnoxious odors of other than that of natural origin.

Temperature °F	Not more than 90

Oil

Substantially free of visible floating oil.

Floating Solids and Debris

Substantially free of floating solids and debris from other than natural sources.

Bottom Deposits

Substantially free of sludge banks.

pH - Units

Annual Median	Within range 6.5 - 9.0

Dissolved Oxygen - mg/1 (Tentative)

Average (May through September)	3.0
Single Daily Value or Average	Not less than 1.0

BOD - mg/1 (Tentative)

Single value	Less than 10.0

Ammonia-Nitrogen - mg/1 (Tentative)

Single Value	Not more than 5.0

TABLE 5 (Continued)

CRITERIA (Continued)

GRAND CALUMET RIVER [1]

Methylene Blue Active Substances - mg/1 (Tentative)	
Single Value	Not more than 0.5
Chlorides - mg/1 (Tentative)	
Annual Average	75
Single Daily Value or Average	Not more than 125
Phenol-like Substances - mg/1 (Tentative)	
Single Value	Not more than 0.020
Total Phosphates - mg/1 (Tentative)	
Held for additional data analysis	
Filterable Residue (Total Dissolved Solids) mg/1 (Tentative)	
Single Value	Not more than 500

(1) It is recognized that the Grand Calumet River at the State Line is essentially treatment plant effluent from Hammond due to the nature of the natural drainage flow.

In addition to the concentration limits, the pounds per day of each constituent shall be limited to the loads that would occur at these concentrations with a flow of 20 cfs.

Combined storm water overflows shall be eliminated as soon as possible.

Criteria considers only existing conditions. If the proposed dam changes conditions, then the criteria should be reconsidered.

(2) If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

TABLE 6

CRITERIA

WOLF LAKE

Control Point - Illinois-Indiana State Line-Wolf Lake Culvert[1]

Bacteria - Number per 100 ml by MF Techniques (Tentative) (2)

a) The number of bacteria shall be the Arithmetic Average of the last five consecutive sample results.

b) Satisfactory area if MF Coliform are less than 1000 and MF Fecal Streptococci are less than 100.

c) Satisfactory area if MF Coliforms are from 1000 to 5000 and MF Fecal Streptococci are less than 20.

d) A single sample result of over 100,000 Coliforms shall require immediate investigation as to the cause. Items to be considered in the judgment of cause and action to be taken include the sanitary survey, winds, currents and weather conditions.

Turbidity

No turbidity of other than natural origin that will cause substantial visible contrast with the natural appearance of water.

True Color - Units

Annual Average	Not more than 5
Single Daily Value or Average	Not more than 15

Odor

No obnoxious odor of other than natural origin.

Temperature - °F — Not more than 85

Oil

Substantially free of visible floating oil.

Floating Solids and Debris

Substantially free of floating solids and debris from other than natural sources.

Bottom Deposits

Substantially free of muck and debris of other than natural origin.

pH - Units

Daily Median — Within range 7.0 - 9.0

TABLE 6 (Continued)

CRITERIA (Continued)

WOLF LAKE

Dissolved Oxygen - Per Cent Saturation	
Annual Average	Not less than 90
Single Value	Not less than 80
Ammonia Nitrogen (N) - mg/1 (Tentative) (3)	
Annual Average	Not more than 0.05
Single Daily Value or Average	Not more than 0.12
Methylene Blue Active Substance - mg/1	
Annual Average	Not more than 0.02
Single Daily Value or Average	Not more than 0.05
Cyanides (CN) - mg/1	
Single Value	Not more than 0.025
Total Phosphates (PO_4) - mg/1 (Tentative) (4)	
Annual Average	Not more than 0.03
Single Daily Average or Value	Not more than 0.04

(1) Criteria apply at beaches as well as at Toll Road Bridge Station

(2) Pending evaluation of data on bathing beaches during 1965 which are now being collected.

(3) Pending study of additional data and evaluation of potential reductions at the sources.

(4) Pending thorough determination of existing concentrations in Lower Lake Michigan Conference Area. Lower limits may be desirable.

If more than one sample per day is examined, the limit shall be the daily average. If only one sample per day is taken, the single value shall govern.

PROCEDURES FOR APPLICATION OF CRITERIA

CONTROL POINTS

The committee recommends that the following sampling stations serve as control points to judge compliance with the recommended criteria. This recommendation is not intended to exclude sampling at such other points as may be found necessary to ensure effective pollution abatement and continuing monitoring and control of pollution.

OPEN WATER

1. Chicago South District Filtration Plant - Dunne or Shore Intake Crib, or both in combination.
2. Gary Water Intake, West.

INNER HARBOR BASINS

1. Hammond Water Intake.
2. East Chicago Water Intake.

SHORE WATER

Existing sampling points at bathing beaches.

LITTLE CALUMET RIVER

Wentworth Avenue Bridge.

GRAND CALUMET RIVER

Baltimore and Ohio Chicago Terminal Railroad Bridge.

WOLF LAKE

Culvert through Earthen Dike Road on Illinois-Indiana State line.

LABORATORY METHODS

Analytical methods shall adhere to the procedures approved by the Laboratory Directors representing the Illinois and Indiana pollution control agencies, the Metropolitan Sanitary District of Greater Chicago, the Chicago Bureau of Water and the Great Lakes-Illinois River Basins (GLIRB) Project.

The technical committee is aware of the variations in the procedures followed in determination of threshold odor by the several laboratories involved and that none adheres to "Standard Methods," and recognizes that quantitative values reported by the laboratories quite probably have little true relationship to each other. In order to place threshold odor results on a comparable basis until a uniform procedure can be adopted, the committee recommends that all official determinations be performed by one organization, such as the Chicago South District Filtration Plant. In this way the South District Filtration Plant method would serve temporarily as a standard for reference procedure.

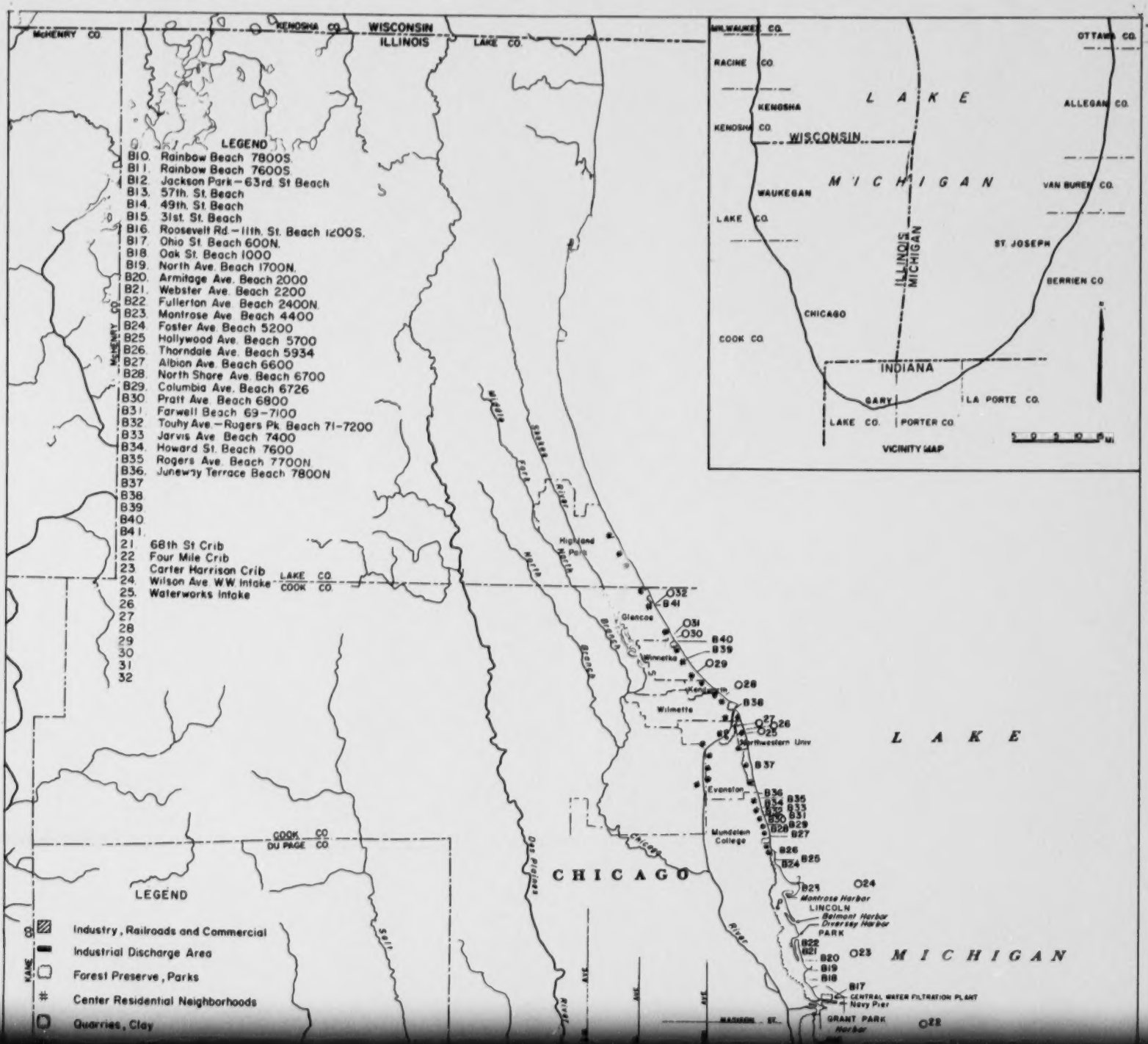
Recent discovery of wide variations in ammonia results obtained by four laboratories on two samples has cast some doubt on the comparability of analytical results. The program of the Laboratory Directors to achieve uniformity in methods and results should be pressed with all possible speed.

GPO 825-212-3

APPENDIX

LAKE CO.
COOK CO.
WINNETKA
KENILWORTH
WILMETTE
EVANSTON
LAKE
MICHIGAN
N
CHICAGO
CHICAGO-DUNNE CRIB
SHORE INTAKE CRIB
ILLINOIS
MICHIGAN
ILLINOIS
INDIANA
OPEN
WATER
HAMMOND
E. CHICAGO
INTAKE
GARY-WEST INTAKE
U.S. STEEL
INTAKE
LAKE CO.
PORTER CO.
GARY
HAMMOND
LEGEND-
Control Point
Inner Harbor Line
Area Boundary
SCALE
0 1 2 3 4 5 Miles
ILLINOIS
INDIANA
LOCATION MAP
CALUMET-LOWER LAKE MICHIGAN

FIGURE 1


LEGEND
B10. Rainbow Beach 7800S.
B11. Rainbow Beach 7600S.
B12. Jackson Park – 63rd. St Beach
B13. 57th. St. Beach
B14. 49th. St. Beach
B15. 31st. St. Beach
B16. Roosevelt Rd. – 11th. St. Beach 1200S.
B17. Ohio St. Beach 600N.
B18. Oak St. Beach 1000
B19. North Ave. Beach 1700N.
B20. Armitage Ave. Beach 2000
B21. Webster Ave. Beach 2200
B22. Fullerton Ave. Beach 2400N.
B23. Montrose Ave. Beach 4400
B24. Foster Ave. Beach 5200
B25. Hollywood Ave. Beach 5700
B26. Thorndale Ave. Beach 5934
B27. Albion Ave. Beach 6600
B28. North Shore Ave. Beach 6700
B29. Columbia Ave. Beach 6726
B30. Pratt Ave. Beach 6800
B31. Farwell Beach 69–7100
B32. Touhy Ave. – Rogers Pk. Beach 71–7200
B33. Jarvis Ave. Beach 7400
B34. Howard St. Beach 7600
B35. Rogers Ave. Beach 7700N.
B36. Juneway Terrace Beach 7800N
B37
B38
B39
B40
B41
21 68th St Crib
22 Four Mile Crib
23 Carter Harrison Crib
24. Wilson Ave. WW Intake
25. Waterworks Intake
26
27
28
29
30
31
32
LAKE CO
COOK CO
WISCONSIN
ILLINOIS
LAKE CO.
MCHENRY CO
KENOSHA CO
COOK CO
DU PAGE CO
KANE CO
LEGEND
Industry, Railroads and Commercial
Industrial Discharge Area
Forest Preserve, Parks
Center Residential Neighborhoods
Quarries, Clay
CHICAGO
LAKE
MICHIGAN
Glencoe
Winnetka
Kenilworth
Wilmette
Northwestern Univ
Evanston
Mundelein College
Highland Park
Des Plaines River
CHICAGO RIVER
Monroe Harbor
LINCOLN PARK
Belmont Harbor
Diversey Harbor
CENTRAL WATER FILTRATION PLANT
Navy Pier
GRANT PARK
Harbor
MADISON ST.
AVE
VICINITY MAP
MILWAUKEE CO.
RACINE CO.
KENOSHA
KENOSHA CO.
WISCONSIN
WAUKEGAN
LAKE CO.
COOK CO.
CHICAGO
ILLINOIS
MICHIGAN
OTTAWA CO.
ALLEGAN CO.
VAN BUREN CO.
ST. JOSEPH
BERRIEN CO
INDIANA
GARY
LA PORTE CO.
LAKE CO.
PORTER CO.
5 0 5 10 15 Mi

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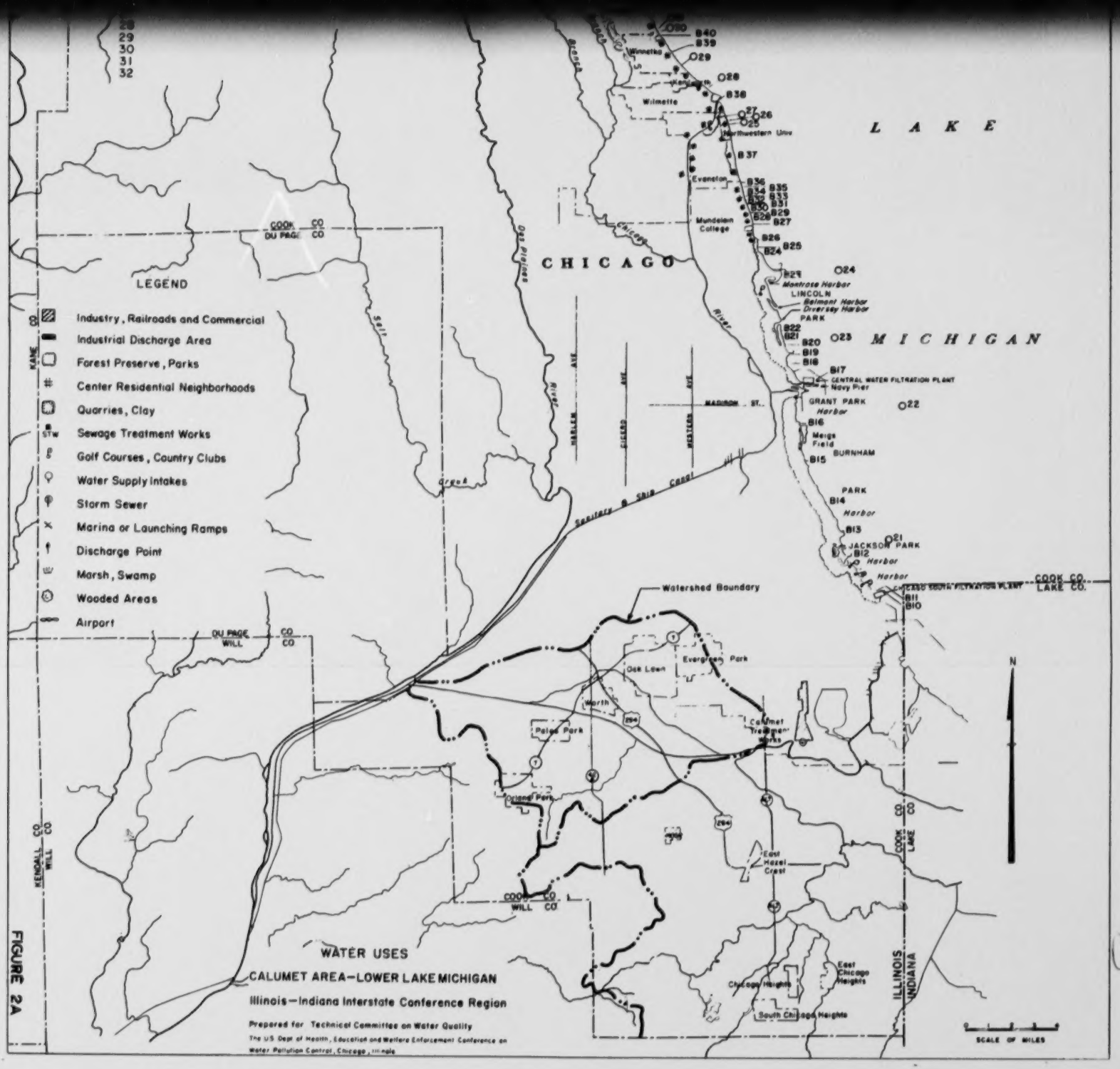

FIGURE 2A

WATER USES

CALUMET AREA—LOWER LAKE MICHIGAN

Illinois—Indiana Interstate Conference Region

Prepared for Technical Committee on Water Quality

The U.S. Dept. of Health, Education and Welfare Enforcement Conference on Water Pollution Control, Chicago, Illinois

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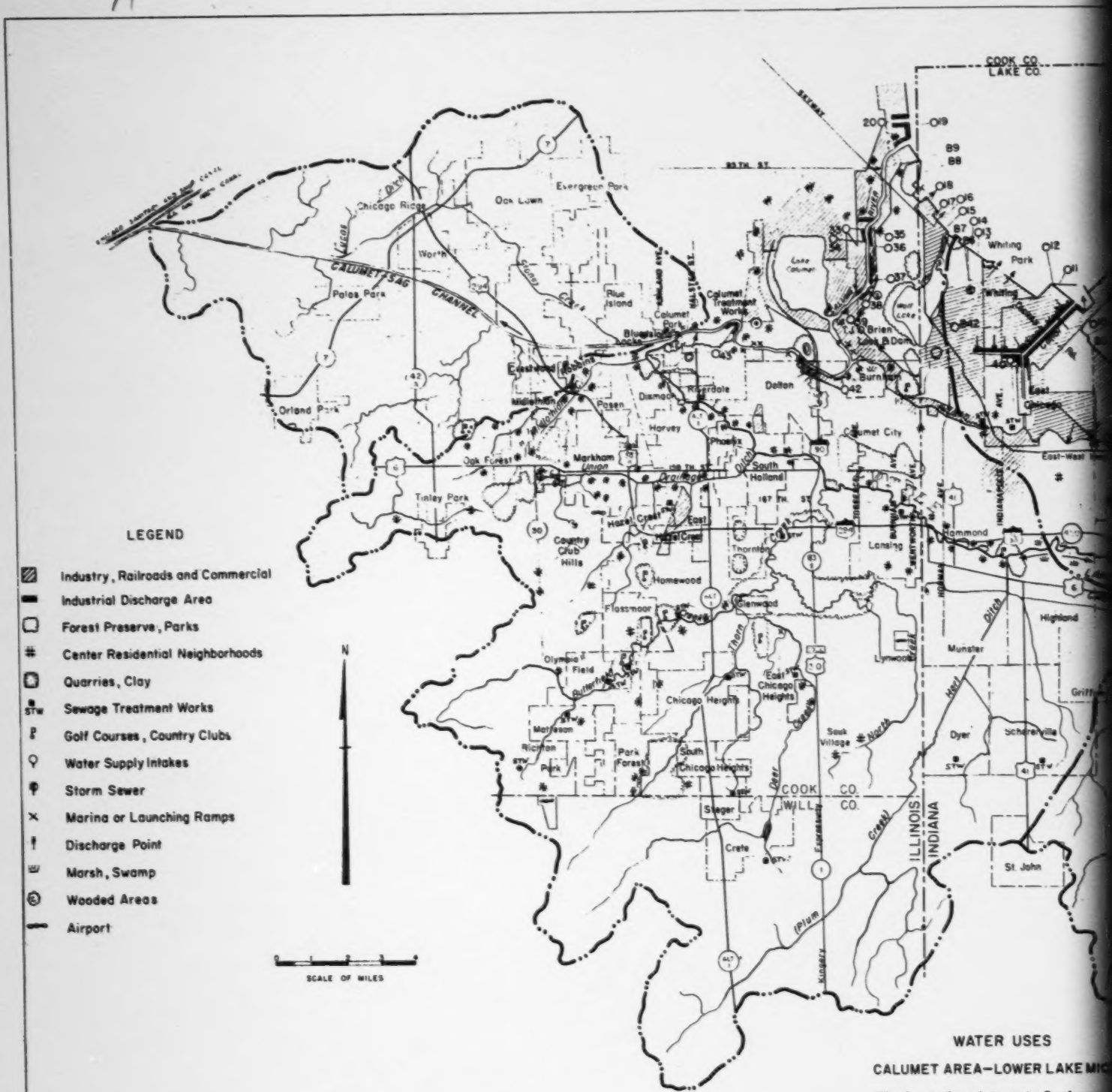

WATER USES

CALUMET AREA—LOWER LAKE MIC

Illinois—Indiana Interstate Conferenc

Prepared for: Technical Committee on Water Qu

The U.S. Dept of Health, Education and Welfare Enforcemen

Water Pollution Control, Chicago, Illinois

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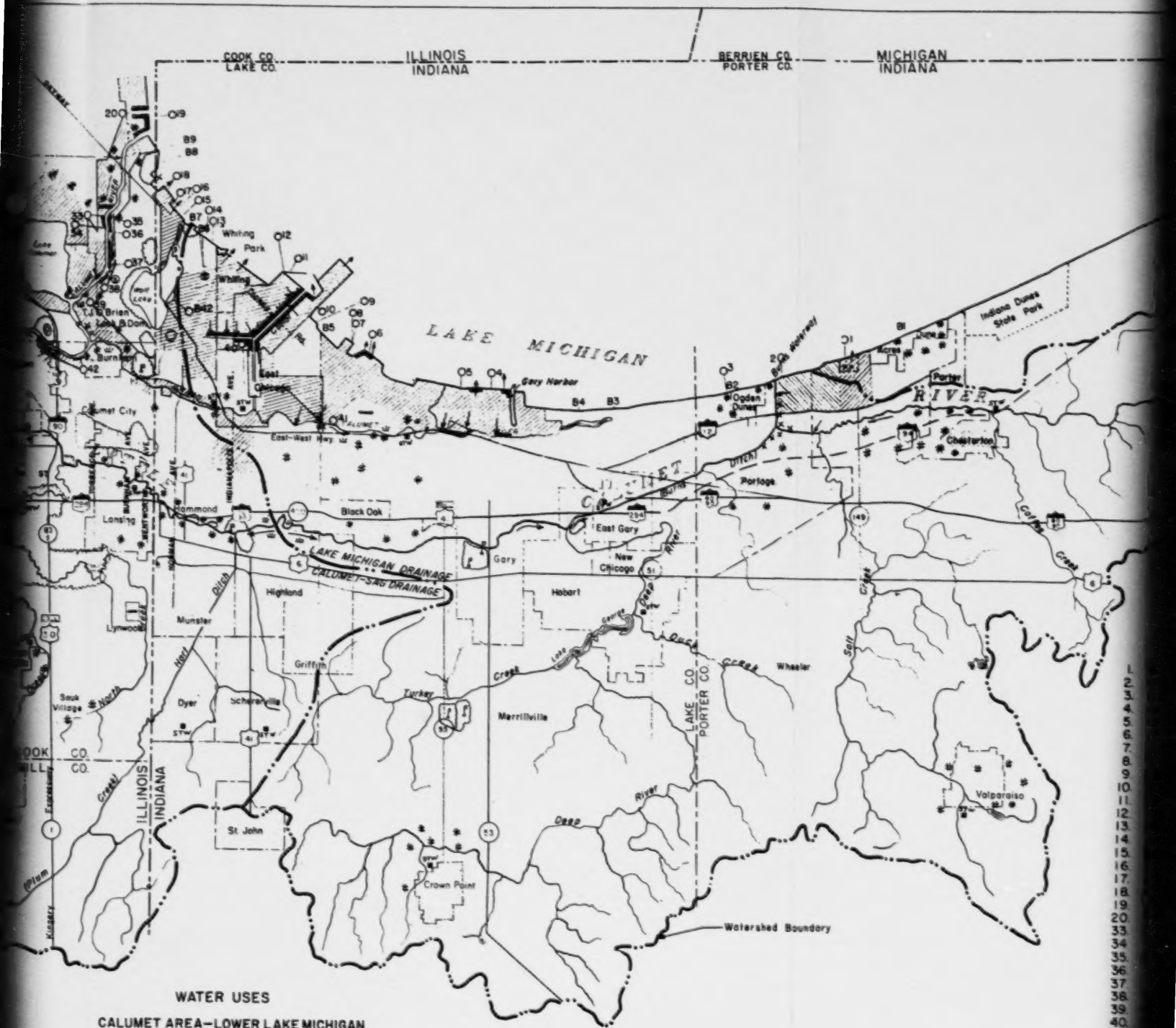

WATER USES

CALUMET AREA—LOWER LAKE MICHIGAN

Illinois—Indiana Interstate Conference Region

Prepared for: Technical Committee on Water Quality

The U.S. Dept. of Health, Education and Welfare Enforcement Conference on Water Pollution Control, Chicago, Illinois

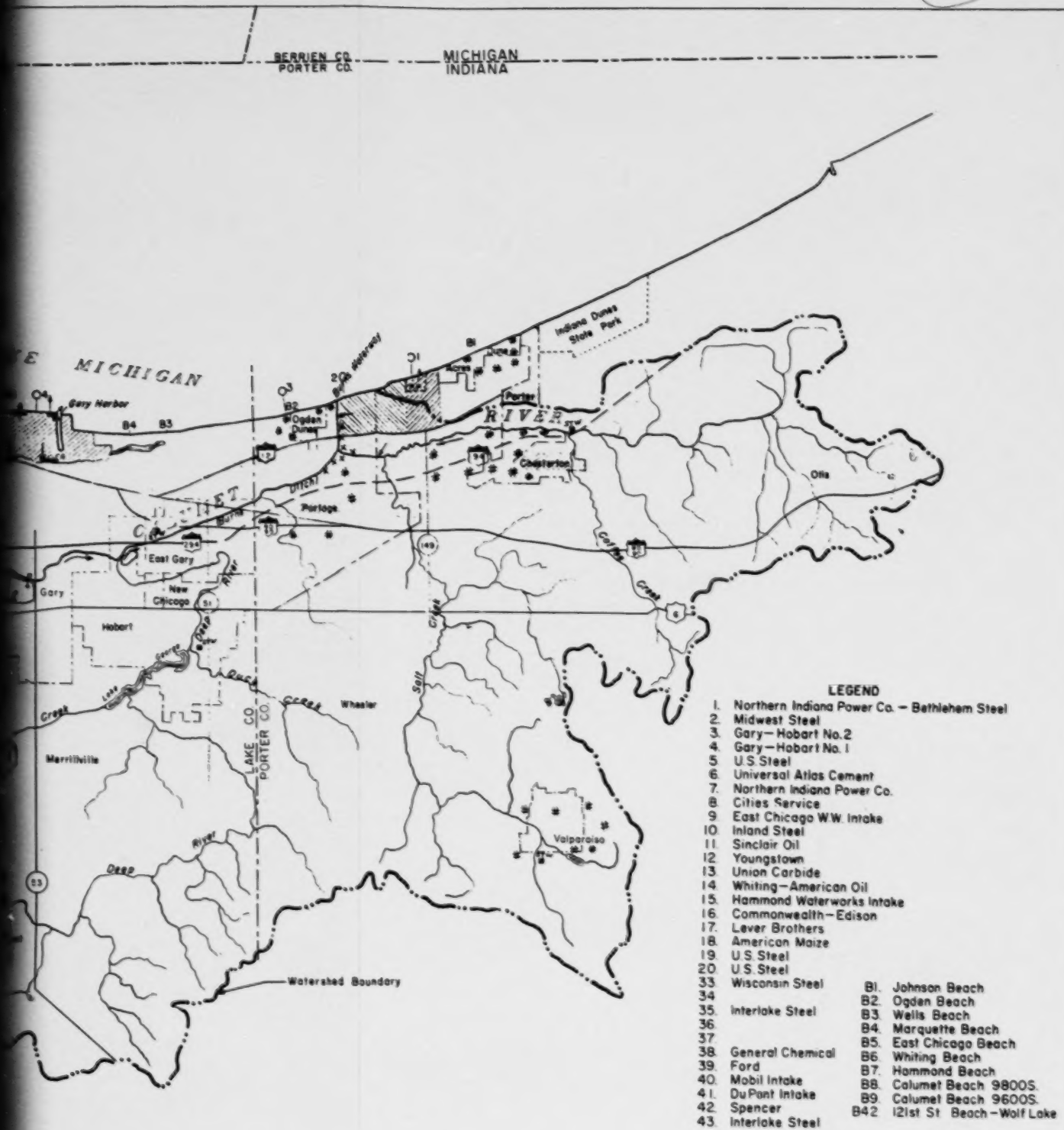
BERRIEN CO.
PORTER CO.
MICHIGAN
INDIANA
MICHIGAN
Gary Harbor
B4
B3
B2
Ogden Dunes
B1
Indiana Dunes State Park
Porter
RIVER
Chesterton
Portage
Ditch
East Gary
New Chicago
Gary
Hobart
Deep River
Burns Ditch
Salt Creek
Wheeler
Merrillville
LAKE CO.
PORTER CO.
Valparaiso
Watershed Boundary
Otis
Galena
Creek
LEGEND
1. Northern Indiana Power Co. – Bethlehem Steel
2. Midwest Steel
3. Gary–Hobart No. 2
4. Gary–Hobart No. 1
5. U.S. Steel
6. Universal Atlas Cement
7. Northern Indiana Power Co.
8. Cities Service
9. East Chicago W.W. Intake
10. Inland Steel
11. Sinclair Oil
12. Youngstown
13. Union Carbide
14. Whiting–American Oil
15. Hammond Waterworks Intake
16. Commonwealth–Edison
17. Lever Brothers
18. American Maize
19. U.S. Steel
20. U.S. Steel
33. Wisconsin Steel
34.
35. Interlake Steel
36.
37.
38. General Chemical
39. Ford
40. Mobil Intake
41. Du Pont Intake
42. Spencer
43. Interlake Steel
B1. Johnson Beach
B2. Ogden Beach
B3. Wells Beach
B4. Marquette Beach
B5. East Chicago Beach
B6. Whiting Beach
B7. Hammond Beach
B8. Calumet Beach 9800S.
B9. Calumet Beach 9600S.
B42 121st St Beach – Wolf Lake

FIGURE 2B

TABLE I

EXISTING AND POTENTIAL WATER USES

AREA AS DEFINED / USES	Municipal Water	Industrial Water-Processing and cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Shipping	Esthetics	Wastewater Assimilation
Open Water	X	X		X	X	X	X	X
Inner Harbor Basins	X	X		X	X	X	X	X
Shore Water			X	X	X		X	X
Little Calumet River				X	O		X	X
Grand Calumet River		X					X	X
Wolf Lake			X	X	X		X	X
X - Present Use O - Future Use								

TABLE II

CONSTITUENTS CONSIDERED FOR WATER QUALITY CRITERIA

Open Lake and Inner Harbor Basins — USES / CONSTITUENTS	Municipal Water	Industrial Water - Processing	Industrial Water - Cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Shipping	Esthetics	Wastewater Assimilation
Coliform Bacteria	X				X				
Fecal Streptococcus	X				X				
Turbidity		X	X			X		X	
Color (True)	X	X						X	
Threshold Odor Number	X								
Odor					X			X	
Temperature		X	X			X			X
Oil					X	X	X	X	
Floating Solids and Debris					X		X	X	
Bottom Deposits						X			
pH	X	X	X		X	X	X		
Dissolved Oxygen	X	X			X	X			X
BOD									X
Ammonia Nitrogen	X	X				X			
Nitrogen (Total)								X	
Meth. Blue Act. Substance	X	X			X	X		X	
Chloride	X	X							
Cyanide	X					X			
Fluoride	X								
Dissolved Iron	X								
Phenol-like Substances	X	X				X			
Sulfates	X								
Phosphates (Total)	X							X	
Filtrable Residue (Tot. D'd Solids)	X	X							
Misc. Trace Contaminants	X					X			
Radionuclides	X					X			

TABLE III

CONSTITUENTS CONSIDERED FOR WATER QUALITY CRITERIA

Shore Water USES / CONSTITUENTS	Municipal Water	Industrial Water - Processing	Industrial Water - Cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Shipping	Esthetics	Wastewater Assimilation
Coliform Bacteria				X	X				
Fecal Streptococcus				X	X				
Turbidity				X		X		X	
Color (True)				X				X	
Threshold Odor Number									
Odor				X	X			X	
Temperature				X		X			X
Oil				X	X	X		X	
Floating Solids and Debris				X	X			X	
Bottom Deposits				X		X			
pH				X	X	X			X
Dissolved Oxygen				X	X	X			X
BOD									X
Ammonia Nitrogen						X			
Nitrogen (Total)								X	
Meth. Blue Act. Substance				X	X	X		X	
Chloride									
Cyanide				X		X			
Fluoride									
Dissolved Iron									
Phenol-like Substances						X			
Sulfates									
Phosphates (Total)								X	
Filtrable Residue (Tot. D'd Solids)									
Misc. Trace Contaminants						X			
Radionuclides						X			

TABLE IV

CONSTITUENTS CONSIDERED FOR WATER QUALITY CRITERIA

Little Calumet River From State Line to Junction With Calumet Sag. Channel — USES / CONSTITUENTS	Municipal Water	Industrial Water - Processing	Industrial Water - Cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Shipping	Esthetics	Wastewater Assimilation
Coliform Bacteria					X				
Fecal Streptococcus					X				
Turbidity						X		X	
Color (True)								X	
Threshold Odor Number									
Odor					X			X	
Temperature						X			X
Oil					X	X		X	
Floating Solids and Debris					X			X	
Bottom Deposits						X			
pH					X	X			X
Dissolved Oxygen					X	X			X
BOD									X
Ammonia Nitrogen						X			
Nitrogen (Total)								X	
Meth. Blue Act. Substance					X	X		X	
Chloride									
Cyanide						X			
Fluoride									
Dissolved Iron									
Phenol-like Substances						X			
Sulfates									
Phosphates (Total)								X	
Filtrable Residue (Tot. D'd Solids)									
Misc. Trace Contaminants						X			
Radionuclides						X			

TABLE V

CONSTITUENTS CONSIDERED FOR WATER QUALITY CRITERIA

Grand Calumet River State Line to Junction with Calumet River CONSTITUENTS	Municipal Water	Industrial Water - Processing	Industrial Water - Cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Fishing	Esthetics	Wastewater Assimilation
Coliform Bacteria									
Fecal Streptococcus									
Turbidity		X	X					X	
Color (True)		X						X	
Threshold Odor Number									
Odor								X	
Temperature		X	X						X
Oil								X	
Floating Solids and Debris								X	
Bottom Deposits								X	
pH		X	X						X
Dissolved Oxygen		X							X
BOD									X
Ammonia Nitrogen		X						X	
Nitrogen (Total)								X	
Meth. Blue Act. Substance		X							
Chloride		X							
Cyanide									
Fluoride									
Dissolved Iron									
Phenol-like Substances		X							
Sulfates									
Phosphates (Total)								X	
Filtrable Residue (Tot. D'd Solids)		X							
Misc. Trace Contaminants									
Radionuclides									

TABLE VI

CONSTITUENTS CONSIDERED FOR WATER QUALITY CRITERIA

Wolf Lake USES / CONSTITUENTS	Municipal Water	Industrial Water - Processing	Industrial Water - Cooling	Recreation - Whole Body Contact	Recreation - Limited Body Contact	Fish and Wildlife	Commercial Shipping	Esthetics	Wastewater Assimilation
Coliform Bacteria				X	X				
Fecal Streptococcus				X	X				
Turbidity				X		X		X	
Color (True)				X				X	
Threshold Odor Number									
Odor				X	X			X	
Temperature				X		X			X
Oil				X	X	X		X	
Floating Solids and Debris				X	X			X	
Bottom Deposits				X		X			
pH				X	X	X			X
Dissolved Oxygen				X	X	X			X
BOD									X
Ammonia Nitrogen						X			
Nitrogen (Total)								X	
Meth. Blue Act. Substance				X	X	X		X	
Chloride									
Cyanide				X		X			
Fluoride									
Dissolved Iron									
Phenol-like Substances						X			
Sulfates									
Phosphates (Total)								X	
Filtrable Residue (Tot. D'd Solids)									
Misc. Trace Contaminants						X			
Radionuclides						X			

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